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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
B21J 15/30, 15/32, B25B 23/08, 23/10

A1

(11) International Publication Number: WO 95/28242

(43) International Publication Date: 26 October 1995 (26.10.95)

(21) International Application Number: PCT/AU95/00219

(22) International Filing Date: 18 April 1995 (18.04.95)

(30) Priority Data:
PM 5070 14 April 1994 (14.04.94) AU

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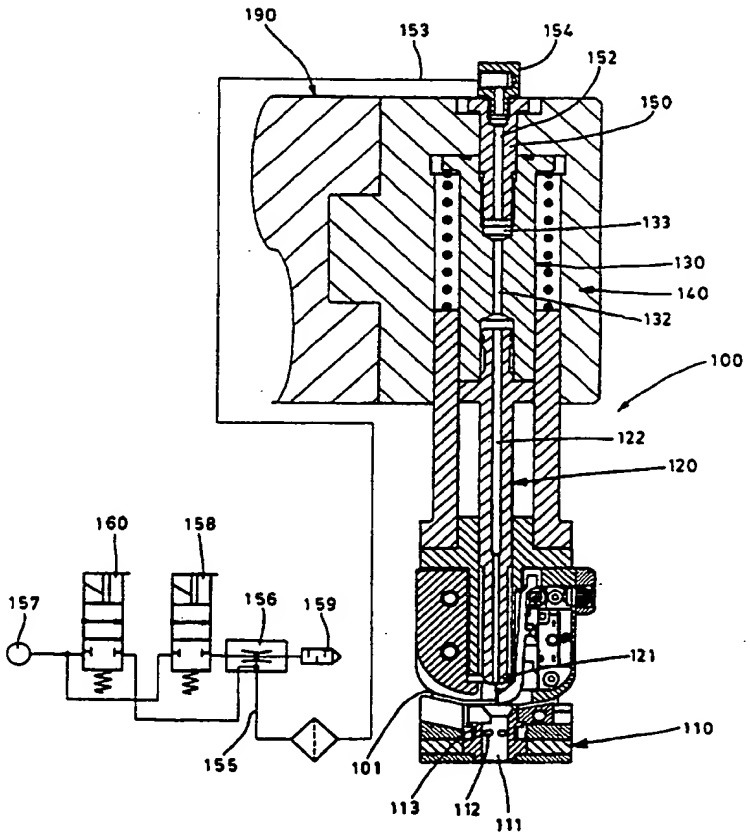
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published
With international search report.

(54) Title: IMPROVED FASTENING MACHINES

(57) Abstract

A fastening machine (100) has a punch (120) with a vacuum passage (122) therethrough. The vacuum passage (122) is connected to a vacuum source (156) to selectively retain a rivet (10) on the nose (121) of the punch (120). Balls (112) in the rivet delivery passage (111) in the setting tool (110) centralise the rivet (10) on the punch (120). The rivets (10) may be, alternatively, releasably retained on the punch by contact adhesive, an electromagnet or permanent magnet.



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TITLE: "IMPROVED FASTENING MACHINES"

BACKGROUND OF THE INVENTION

1. Field of the Invention

THIS INVENTION relates to improved fastening machines. In particular, this invention relates to improved punch/setting tool combinations for fastening machines.

2. Prior Art

US Patent No. 4,615,475 (Fuhrmeister) (= AU-B-28506/84 (566811) = International Publication No. WO 84/04710) discloses a feeder for headed fasteners, where the fasteners, mounted in tape, are sequentially advanced into alignment with the punch and die assembly of a fastening machine by an oscillating actuator, which is timed by the plunger holding the punch, the actuator releasably engaging the stems of the fasteners to advance the fasteners.

The feeder, and the fastening machine, has proved commercially successful in a wide range of industries. There are certain applications, however, eg. in the automotive and white goods industries, where the dimensions of the feeding head preclude the use of the above described type of fastening machine to fasten components together, where limited space is available.

In addition, the minimum radius of curvature of the tape entering and leaving the feeder head also limits the reduction of size of the feeder hereinbefore described to suit such applications.

In our International Application No. PCT/AU94/00013 (International Publication No. WO 94/15730), we disclose improved setting tools for the delivery of fasteners to a workpiece, where the fasteners are centred and stabilized by, eg. pins, balls, fingers, resilient annular discs in the fastener delivery passage. The setting tools are particularly suitable

for fasteners where the stem (or shank) length is less than, or equal to, the diameter of the head.

In certain applications, limited access to the workpieces being fastened precludes the use of the setting tools of the above International Application.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved fastening machine which has better nose access.

It is a preferred object to provide a fastening machine where the centralising elements of the fastening machine can be raised to a position unrelated to fastener length.

It is a further preferred object to provide a vacuum to the fastener actuator to releasably retain the fastener thereto as the fastener is delivered to the workpieces.

It is a still further preferred object to provide a machine where the fastener is centralised on the fastener actuator as it is advanced in the fastener delivery passage.

It is a still further preferred object to provide a machine where the fasteners are fed to the setting tool by tape, blow feed, manually or the like.

The term "fastener" shall include rivets, screws and other like fastening devices.

The term "fastener actuator" includes a punch when the fastener is a rivet; a driver when the fastener is a screw; ie., the tooling appropriate to insert or apply the fastener after its delivery by the nose assembly.

The term "stem" of a fastener shall be hereinafter used to also include a "shank" of a fastener.

The term "fastener support means" includes

means which guide or orient an advancing fastener as occurs, eg. in tape feed machines, where initial support may be by the tape, and the term includes means which engage either or both of the head and stem of an advancing fastener.

In one aspect, the present invention resides in a fastener actuator for a fastening machine wherein:

releasable fastener retaining means on a fastener engaging nose of the actuator releasably secure a fastener to the nose as the fastener is advanced towards a workpiece.

In a second aspect, the present invention resides in a setter tool and fastener actuator assembly for a fastening machine including:

a setter tool having a nose piece with a fastener delivery passage therein and a fastener supply passage to enable fasteners to be transferred from a fastener supply to the fastener delivery passage;

a fastener actuator slidably mounted for movement through the fastener delivery passage to move a fastener therefrom to a workpiece to be fastened thereby;

means operable to advance the fastener actuator through the fastener delivery passage wherein:

releasable fastener retaining means on a fastener engaging nose on the fastener actuator to releasably secure a fastener to the nose as the actuator moves through the fastener delivery passage and is advanced towards the workpiece.

The releasable fastener retaining means may include a vacuum; magnet (permanent or switched electromagnet); contact adhesive or other suitable means.

In third and fourth aspects, the present invention resides in a fastening machine incorporating

the fastener actuator of the first embodiment, or the assembly of the second embodiment, respectively.

Where the releasable fastener retaining means is a vacuum, preferably at least one passage is provided through the actuator, open at one end to the fastener engaging nose, and connected at its other end to a source of vacuum via a control valve. The source of vacuum may be connected to a chamber which surrounds a portion of the actuator and port means in the actuator are selectively connected to the vacuum chamber as the actuator is advanced to provide the control valve means.

The fastener may be centralised relative to the fastener delivery passage, and the actuator, by balls, pins, fingers, rings or the like in the passage; or be received in a recess in the nose of the actuator; or have protrusion(s) on the fastener head to engage complementary recess(es) on the nose.

BRIEF DESCRIPTION OF THE DRAWINGS

To enable the invention to be fully understood, preferred embodiments will now be described with reference to the accompanying drawings, in which:

FIGS 1 and 2 show the relative dimensions of a rivet and a passage therefor;

FIG 3 is a sectional side view of a conventional fastening machine (not forming part of the present invention);

FIG 4 is a sectional side vie of a first embodiment of the invention;

FIG 5 is a sectional side view of a second embodiment;

FIG 6 is a bottom sectional view taken on line 6-6 on FIG 5;

FIG 7 is a sectional side view of a third embodiment;

FIG 8 is a bottom plan view of the third

embodiment;

FIGS 9 to 14 are sectional side views of respective fourth to ninth embodiments;

FIG 15 is a sectional end view of the embodiment of FIG 14;

FIGS 16 to 19 are sectional side views of tenth to thirteenth embodiments of the invention;

FIGS 20 and 21 are sectional side views of a fourteenth embodiment;

FIGS 22 to 24 are sectional side views of fifteenth to seventeenth embodiments of the invention;

FIG 25 is a sectional side view showing the use of the vacuum to enable the handling of rivets in a transfer station; and

FIG 26 is a sectional plan view taken on line 26-26 on FIG 25.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGS 1 and 2, a rivet 10 (FIG 1) with a diagonal dimension D (eg. 8.1mm) will not tumble when passed through a tube or body 20 with a bore or passage 22 of small dimension d (ie. 8.00mm) (FIG 2). The problem of rivets 10 tumbling (and jamming) in a passage 22 is more likely to occur when the head diameter OD is greater than the stem length L (FIG 1).

FIG 3 shows a conventional (ie. prior art) fastening machine 30 where the distance A between the centralising balls 31 in the delivery passage 32 are spaced a distance A from the end 33 of the fastening machine, dependent on the length L of the rivet 10. The punch 34 has a plain rivet engaging nose 35. The centralising balls 31 must be no greater than a distance A from the end 33 to align the rivets 10 with the punch 34.

Referring now to the first embodiment of FIG 4, the riveting machine 100 has a setting tool 110 with

a fastener delivery passage 111 therethrough, which receives rivets from a source (eg. tape) (not shown) via a delivery passage 10 transverse to the fastener delivery passage 111. A single layer of centralising balls 112, backed by resilient springs 113, are provided adjacent the upper end of the fastener delivery passage 111 to centralise the rivets relative to the passage 111 and the nose 121 of the punch 120 mounted on the piston 130 in the cylinder or guide bush 140 of the riveting machine 100.

A vacuum passage 122 extends coaxially with the punch 120 and is connected to a vacuum passage 132 in the piston 130. The passage 132 is connected to a passage 152 through a vacuum fitting 150, fitted to the cylinder 140, and slidably sealed to a bore 133 in the upper end of the piston 130.

A vacuum line 153 connects the vacuum fitting 150, via elbow 154, to the vacuum port 155 of a venturi 156.

Compressed air from the air compressor 157 is directed by the electrically controlled vacuum valve 158 to the venturi 156 (and silencer 159) to generate a vacuum in the venturi 156. When the vacuum valve 157 is switched off, the double solenoid ejector valve 160 is opened to apply a positive pressure to vacuum port 155 to break the vacuum down more rapidly.

A rivet is supplied to the fastener delivery passage 111 (via the supply passage 101) and the piston 120 is advanced towards the workpiece(s) not shown, supported on an upsetting die (not shown) aligned with the piston 120. (The cylinder 140 and upsetting die may be mounted on respective arms of a C-frame 190.)

As, or just before, the nose 121 of the punch 120 contacts the rivet head, the vacuum source is connected (by opening valve 158) to the vacuum passage

122 and so the rivet is drawn onto the punch nose 121. The balls 112 centralise the rivet on the nose 121 and the punch 120 advances the rivet through the fastener delivery passage 111 to the workpiece(s). When the rivet has been upset by the die, the vacuum source is disconnected from the vacuum passage 122 (by closing valve 158) and the punch 120 is retracted. (While the punch is being retracted, a brief blast of pressurised air may be blown through the vacuum passage (by opening valve 160) to clear any debris therefrom (and from the fastener delivery passage 111 and/or to selectively release the fastener from the punch)). It will be noted that the rivet 10, held to the punch 120 by the vacuum, will not tumble or tilt as it is advanced to the workpiece and the centralising balls 112 of the setting tool 110 can be spaced a distance much greater than the distance A of the conventional fastening machine 20, from the workpiece(s).

In the fastening machine 200 of FIGS 5 and 6, a vacuum chamber 223 surrounds the punch 220 and is isolated from the cylinder or guide bush 140, containing the piston 230, by seals or at lapped spool 241 and 241A. Vacuum port 224 in the punch 220 selectively connects the vacuum passage 222 in the piston to the vacuum chamber 223 when the punch 220 has, or is just about to, engage the rivet head and so the punch 220 and chamber 223 co-operate to provide the timed control vacuum for the vacuum passage 222. The vacuum chamber 223 has an inlet 225 mounted on one side of the punch guide head 226, and is connected to the chamber by a port 227.

In this embodiment, the balls 212 are spaced a greater distance below the nose 221 of the punch 220 and so the balls 212 will centralise the rivet on the punch 220 after the rivet has been secured to the nose 221.

The fastener supply passage 201 receives the rivets, via a curved passage 207 in the setting tool 210 from a tube 208 connected to a remote blow feeder (not shown). Three sets of balls 212A engage and support the rivet in the fastener delivery passage 211 before the punch 220 is advanced. A micro switch 216 has a trigger 217 to detect the presence of a rivet in the delivery passage 211, the micro switch preventing advance of the punch 220 when no rivet is detected.

In the third embodiment of FIGS 7 and 8, the fastening machine has its vacuum fitting 150 mounted transversely on the piston 320 and is connected to the vacuum passage 322 by the vacuum port 324. An elongate slot 348 is provided in the cylinder or guide bush 340 to allow the vacuum fitting to advance and retract with the punch 320. The vacuum connection to the vacuum passage 322 is controlled as hereinbefore described with reference to FIG 4.

The fastening machine 400 of the fourth embodiment (see FIG 9) allows a simple nose design for the setting tool 410 and is particularly suitable for rivets 10 where the head diameter OD is greater than the stem length L. Each rivet is supplied via a tape and pushed through the supply passage 401 to the fastener delivery passage 411 and immediately centralised by the balls 412 as the punch 420 is advanced to engage the rivet. The vacuum applied to the rivet head via vacuum passage 422 retains the rivet on the punch nose 421.

FIG 10 shows a fastening machine 500 where the nose 514 of the setting tool 510 is spaced a distance H from the workpieces 50, 58 (and die 570) to prevent damage or marking of the upper surface of workpiece 580. The rivet 10 is carried and retained on the nose 521 of the punch 520 over the distance H, after having been centralised by the balls 512.

The fastening machine 600 (see FIG 11) is similar to the fastening machine 500 of FIG 10, and shows how the machine can be used where access to the workpieces 680, 681 and die 670 is difficult and/or delicate. Once again, the rivet 10 is releasably secured to the nose 621 of the punch 620 via the vacuum in the vacuum passage 622.

The fastening machine 700 (FIG 12) shows the fixing of a deep channel workpieces 780 to a second workpiece 781 where access for the nose 714 of the setting tool 710 is impossible. The nose 714 may have a resilient block or pad 715 to preclamp and/or protect the workpiece 780, 781 before the rivet 10 is advanced by the punch 720 and upset by the die 770.

The fastening machine 800 of FIG 13 enables preclamping of the deep channel workpiece 880 to the workpiece 88 by the nose 814 of the upsetting tool 810 where access is limited. A small cross-sectional area of the nose 814 or, alternatively, high loads can be applied to the nose 814 (without affecting the stress levels which would normally be limited by the provision of the centralising balls 812 near to the bottom of the setting tool 810). Both pre-clamping and post-clamping of the workpieces 880, 881 can be affected.

FIGS 14 and 15 show a fastening machine 900, similar to the fastening machines 600 and 700 of FIGS 11 and 12, where the punch 920 advances the rivet 10 into a channel section workpiece 980, to be fixed to a second workpiece 981. As the workpieces 980, 981 are curved in side view, the distance that the punch 920 must advance the rivet is increased.

FIG 16 shows how a machine 1000, similar to the fastening machines 600, 700 of FIGS 11 and 12 can fix a box section workpiece 1080 to a workpiece 1081 where the punch 1020 advances the rivet through an

access hole 1082.

The fastening machine 1100 of FIG 17 is generally similar to the machine 800 of FIG 13, except that the nose 1114 is relieved at its forward end.

In all of the embodiments of FIGS 4 to 17, the rivets have been centralised relative to the punches by balls or the like in the fastener delivery passages.

In FIG 18, a conical protrusion 11 on the rivet 10 engages a conical socket 1227 in the vacuum passage 1222 at the nose 1221 of the punch 1220 to centralise the rivet 10 to the punch 1220, while in FIG 14, the head 12 of a rivet 10 is received in a complementary socket or recess 1327 in the nose 1321 of the punch 1320, the socket 1327 being connected to the vacuum passage 1322.

The machine 1400 (see FIGS 20 and 21) has a recess 1427 in the nose 1421 of punch 1420, the recess 1427 being dimensioned to receive the head 12 of the rivet 10.

As shown in FIG 21, the nose 1421 of the punch 1420, in the configuration of a peripheral flange, forms an annular recess in the upper workpiece 1483, ie. it "coins" the parent workpiece material about the rivet head 12, after the rivet 10 has been set, to improve the fatigue strength of the joint and/or the aesthetic appearance thereof.

The "coining" of the workpieces is particularly important in the manufacture to include panels from aluminium sheets.

The machine 1100 of FIG 17 can achieve the same objective, except that the "coining" is independent of the punch and can be effected, pre- or post-insertion of the rivet in the workpieces.

The recesses 1227, 1327, 1427 in the punches 1220, 1320, 1420, to centralise the rivets 10, may be

employed in applications where the space(s) adjacent the workpiece(s) are so tight that centralising elements, such as the balls, cannot be provided in the setter tools. They may also be used where a large diameter punch must be used to "coin" the material of the workpiece(s) around the joint, and centralising elements for the rivet would be ineffective (ie. too far away from the rivets or opened by the punch, not the rivets).

As an alternative to vacuum to releasably secure the rivets to the punch nose, contact adhesive may be applied to the heads 12 of the rivets 10, before the rivets are engaged by the punch. In FIG 22, a roller 1502 is provided in the delivery passage 1501 of the setting tool 1510 on fastening machine 1500. A port 1503 connects the roller 1507 to a reservoir 1504 of contact adhesive. As the rivets pass through the delivery passage 1501 to the fastener delivery passage 1511, a thin layer of contact adhesive is applied to the rivet heads 12 by the roller 1502 to enable the rivets to releasably adhere to the nose of the punch (not shown) as the latter advances the rivets to the workpiece(s).

In FIG 23, the punch 1620 of fastening machine 1600 has an electromagnet 1625 in a passage 1622 in the punch 1620. The electromagnet 1626 is connected to a battery (DCV) via a suitable switch (not shown) to selectively retain the rivet on the nose (1621 of the punch 1620.

In FIG 24, a permanent magnet 1725 is provided in the passage 1722 in the punch 1720 of fastening machine 1700. (Preferably, a thin shield is provided in the punch 1720 to protect the punch from becoming magnetised.) The magnet 1726 provides an attractive force to releasably retain the rivet 10 on the punch nose 1721.

Referring now to FIGS 25 and 26, a fastening machine 1800, generally similar to the fastening machine 200 of FIG 5, is supplied with rivets by a transfer station 2000.

Rivets 10, in a tape 19, are released from the tape by a release actuator 2020, which advances the rivets 10 to a stop 2001, in alignment with a transfer actuator 2040. When a rivet 10 is received at the stop 2001, timer means (not shown) cause the pneumatic cylinder 2041 to advance the transfer actuator 2040 to deliver the rivet through the supply passage 1801, to be engaged by the ball 1812 to centralise the rivet in the delivery passage 1811 in the setter tool 1810. Vacuum passage 2022 and 2042 in the actuators 2020 and 2040 are selectively connected to the vacuum source to which passage 1822 in punch 1820 is selectively connected to enable the rivets 10 to be releasably secured to the actuator 2020 and 2040 as the rivets are transferred from the tape 19 to the stop 2001, and from the stop 2001 to the supply passage 1801 in the fastening machine 1800.

In a modified embodiment, the rivets 10 may be supplied to the stop 2001 by a blow-feeding tube (equivalent to tube 208 in FIGS 5 and 6), and the rivets 10 are then delivered to the supply passage 1801 by the transfer actuator 2040.

Various changes and modifications may be made to the embodiments described and illustrated without departing from the scope of the present invention defined in the appended claims.

CLAIMS

1. A fastener actuator for a fastening machine wherein:

releasable fastener retaining means on a fastener engaging nose of the actuator releasably secure a fastener to the nose as the fastener is advanced towards a workpiece.

2. A setter tool and fastener actuator assembly for a fastening machine including:

a setter tool having a nose piece with a fastener delivery passage therein and a fastener supply passage to enable fasteners to be transferred from a fastener supply to the fastener delivery passage;

a fastener actuator slidably mounted for movement through the fastener delivery passage to move a fastener therefrom to workpiece(s) to be fastened thereby; and

means operable to advance the fastener actuator through the fastener delivery passage wherein:

releasable fastener retaining means on a fastener engaging nose on the fastener actuator to releasably secure a fastener to the nose as the actuator moves through the fastener delivery passage and is advanced towards the workpiece.

3. An assembly as claimed in Claim 2 wherein:

the releasable fastener retaining means includes a vacuum; a permanent magnet; switched electromagnets; or contact adhesive.

4. An assembly as claimed in Claim 3 wherein:

the releasable fastener retaining means is a vacuum, at least one passage is provided through the actuator, open at one end to the fastener engaging nose, and is connected at its other end to a source of vacuum via a control valve.

5. An assembly as claimed in Claim 4 wherein:

the source of vacuum is connected to a chamber which surrounds a portion of the actuator; and

port means in the actuator are selectively connected to the vacuum chamber as the actuator is advanced to provide the control valve means.

6. An assembly as claimed in any one of Claims 2 to 6 wherein:

the fastener is centralised relative to the fastener delivery passage, and the actuator, by balls, pins, fingers, rings or the like in the fastener delivery passage; or be received in a recess in the nose of the actuator; or have protrusion(s) on the fastener head to engage complementary recess(es) on the nose.

7. An assembly as claimed in any one of Claims 2 to 6 wherein:

the nose piece engages one of the workpieces to preclamp the workpieces to an upsetting die before the fastener fastens the workpieces together.

8. An assembly as claimed in any one of Claims 2 to 7 wherein:

the fastener engaging nose forms a peripheral flange around a head on the fastener to coin the workpieces about the fastener.

9. An assembly as claimed in Claim 3 wherein:

a roller is provided adjacent the fastener supply passage, connected to a reservoir of contact adhesive, to apply a thin layer of the contact adhesive to heads of fasteners passing through the fastener supply passage, the contact adhesive releasably securing the fasteners to the fastener engaging nose.

10. An assembly as claimed in Claim 3 wherein:

the permanent magnet or switched electromagnet is provided in a passage in the fastener actuator adjacent the fastener engaging nose to releasably secure the fasteners to the fastener engaging nose.

11. An assembly as claimed in any one of Claims 2 to 10 wherein:

the fastener is supplied to the fastener supply passage in a tape or by blow-feeder means.

12. An assembly as claimed in any one of Claims 2 to 10 wherein:

a transfer station has a transfer actuator aligned with the fastener supply passage, and a fastener stop, and releasable fastener retaining means are provided on the transfer actuator to releasably secure the fastener to the transfer actuator as the fastener is transferred from the fastener stop to the fastener supply passage.

13. An assembly as claimed in Claim 12 wherein:

a fastener supply tape is spaced from the fastener stop, and fastener release actuator transfers the fastener from the tape to the fastener stop, the fastener release actuator having releasable fastener retaining means.

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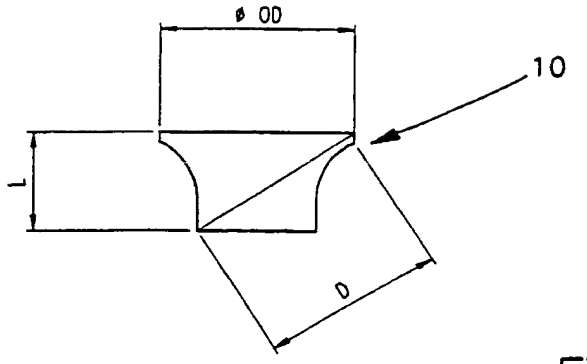

Fig 1

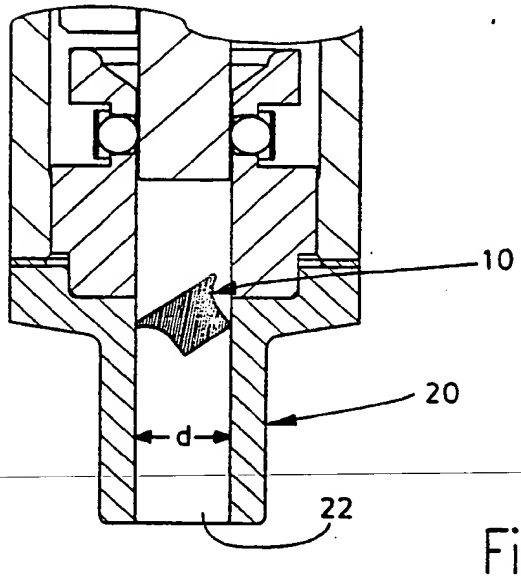

Fig 2

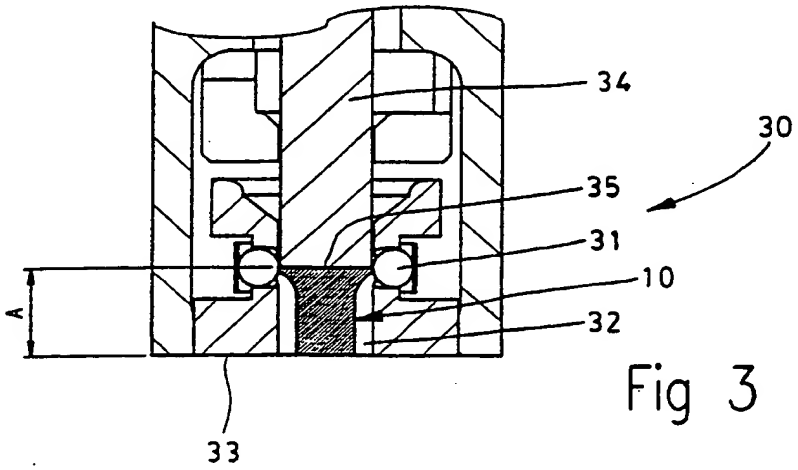

Fig 3

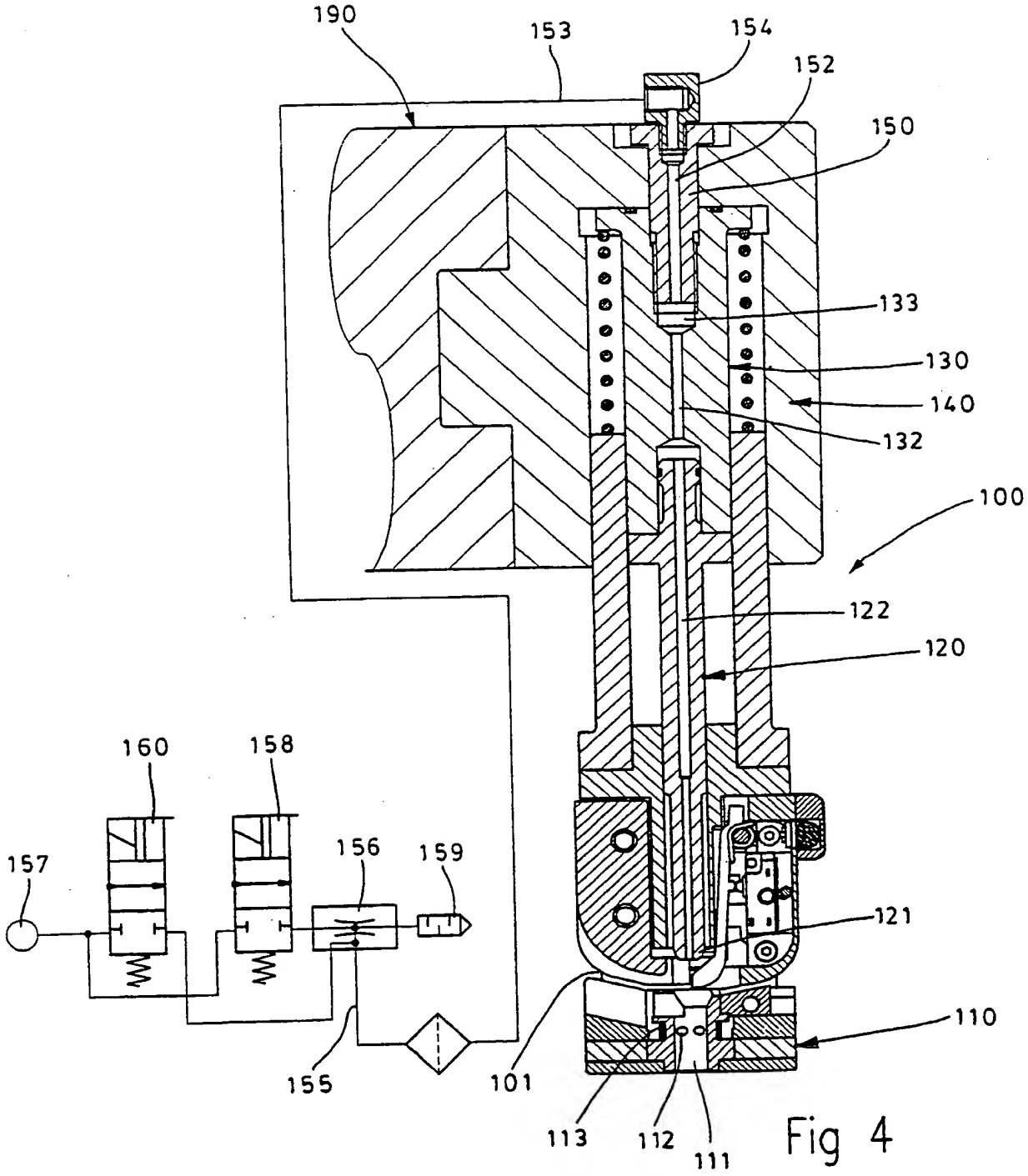
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Fig 4

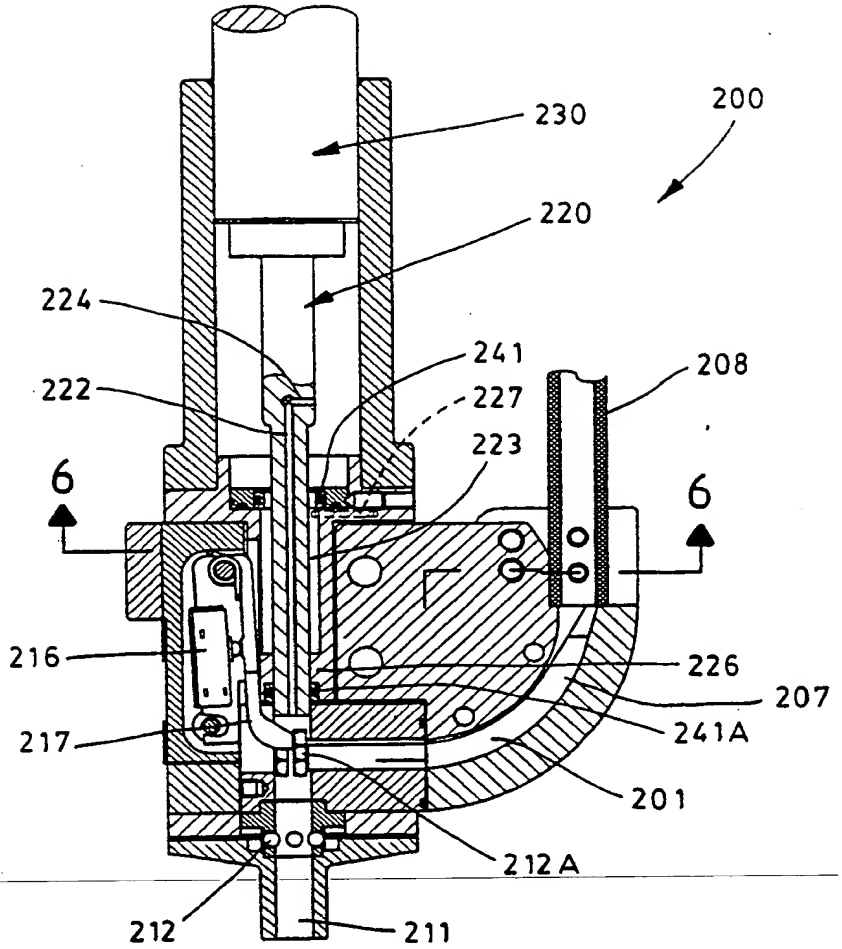


Fig 5

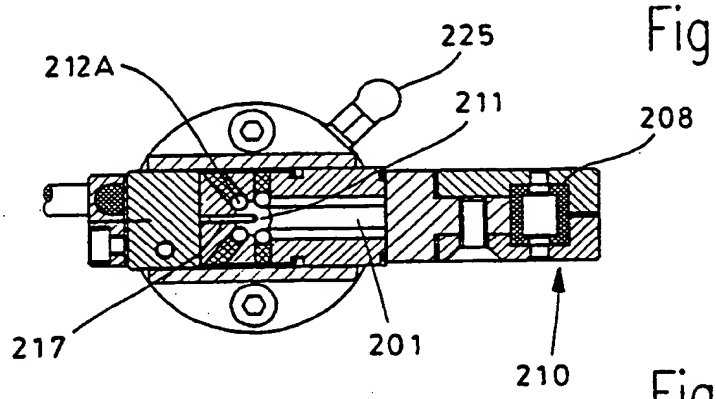


Fig 6

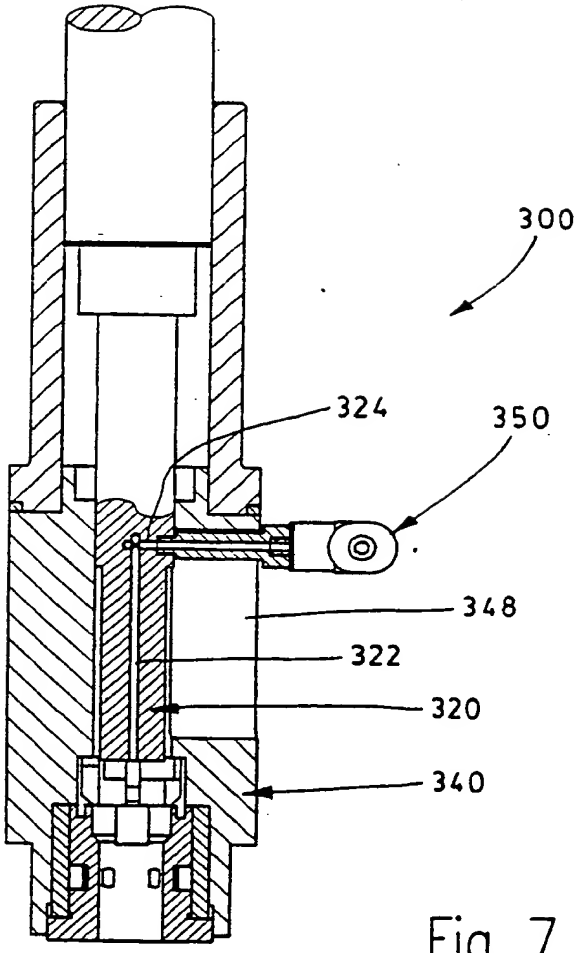


Fig 7

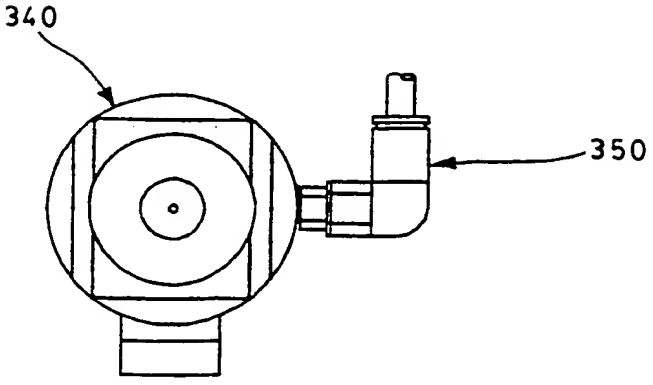


Fig 8

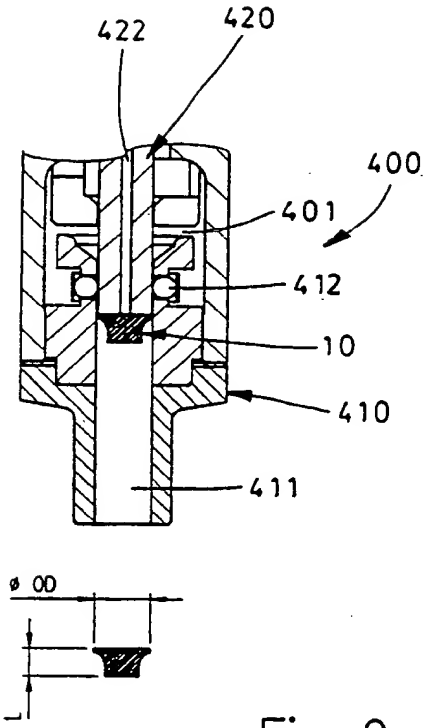


Fig 9

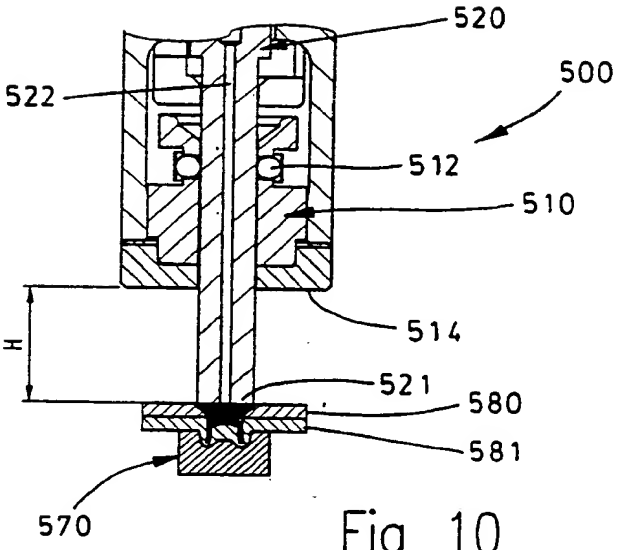


Fig 10

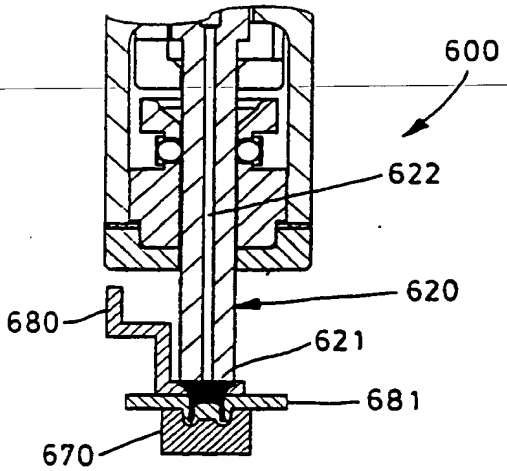


Fig 11

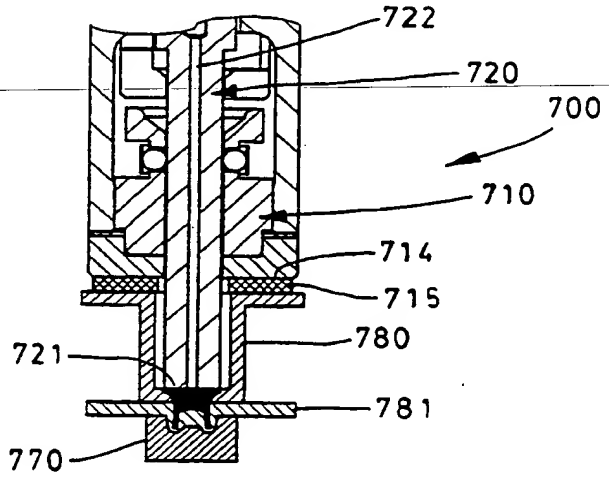


Fig 12

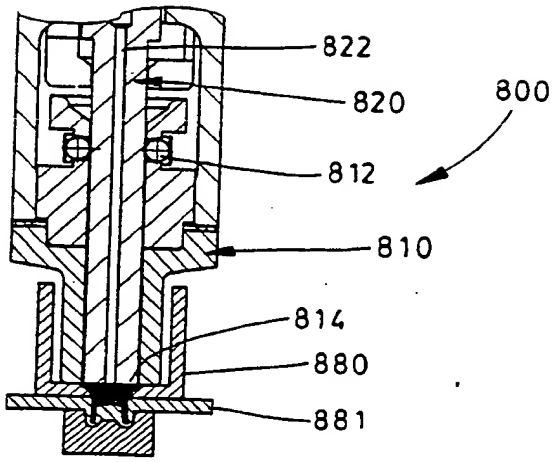


Fig 13

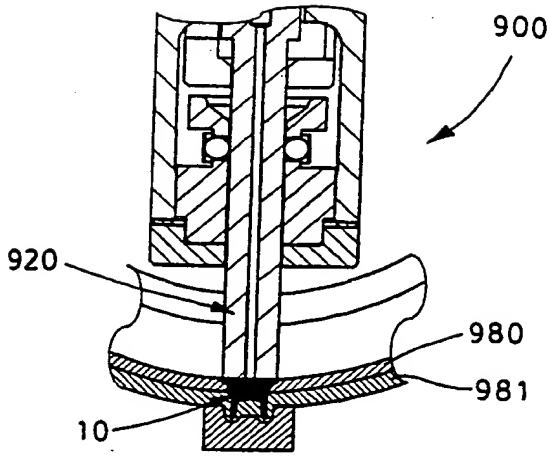


Fig 14

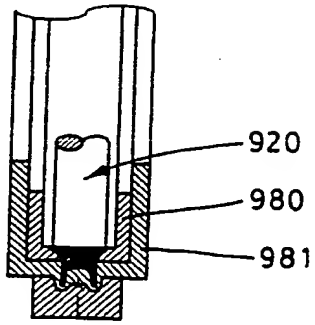


Fig 15

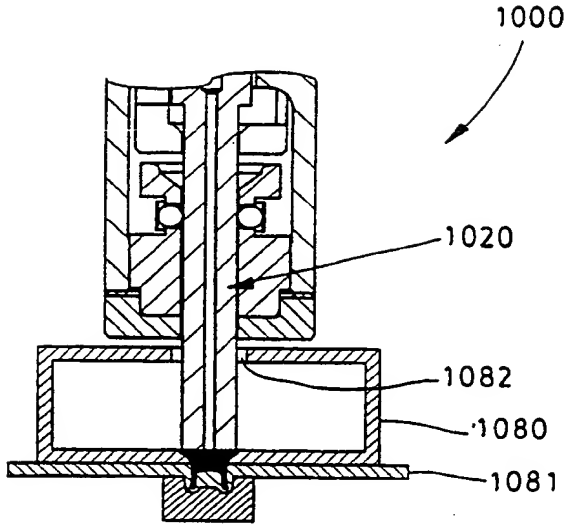


Fig 16

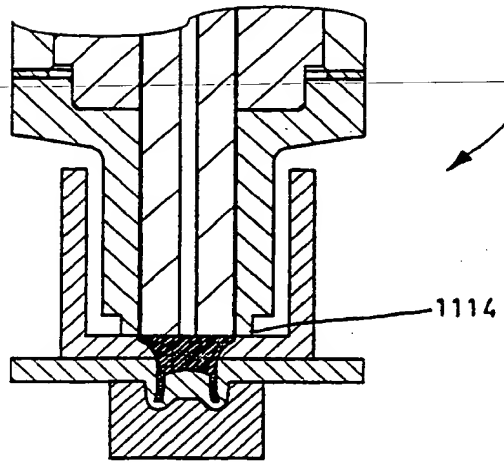


Fig 17

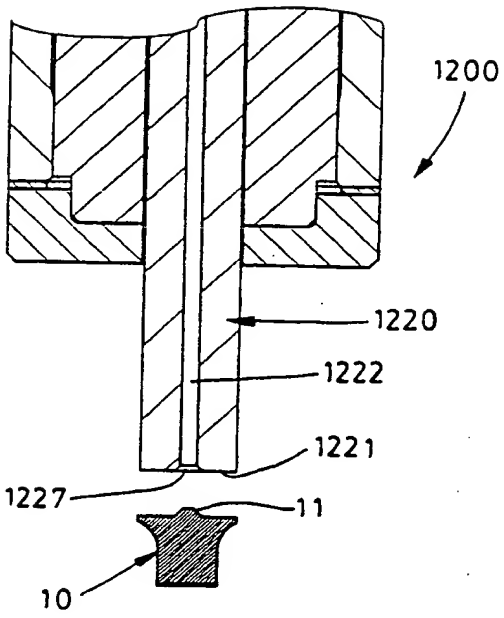
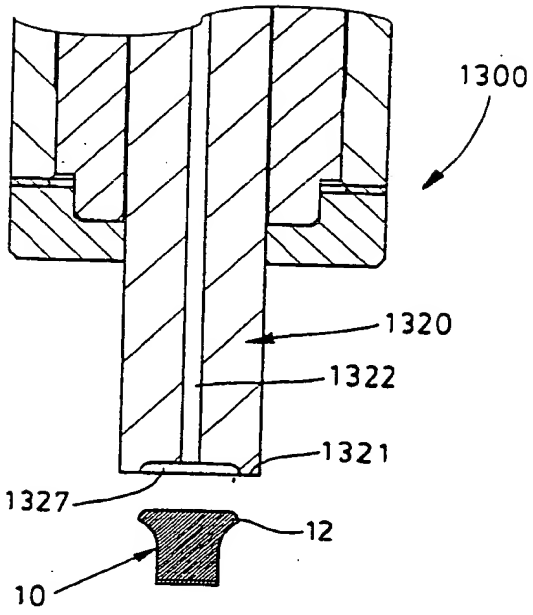


Fig 18



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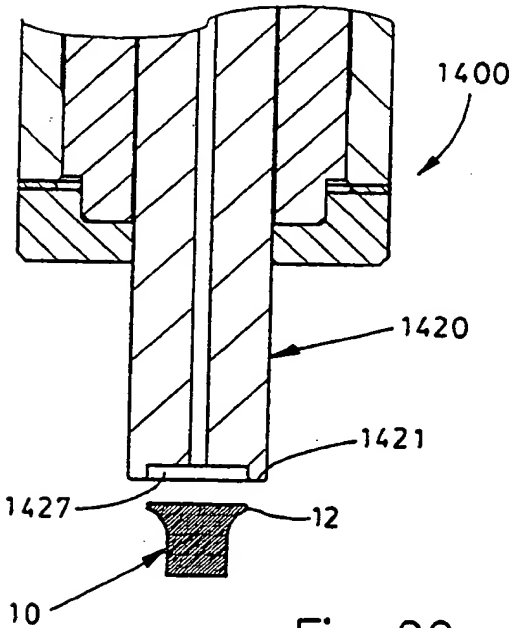


Fig 20

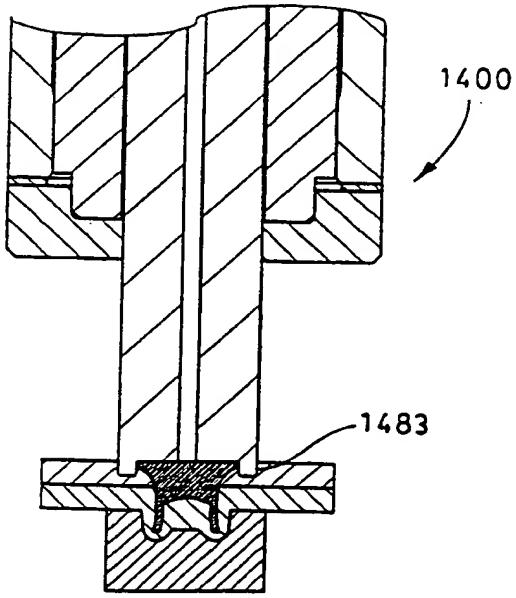


Fig 21

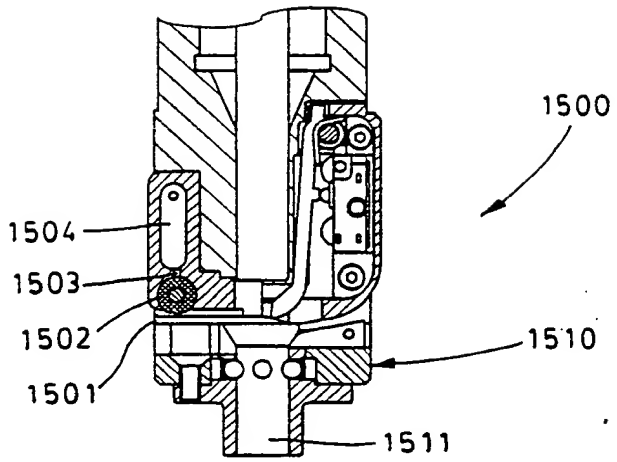


Fig 22

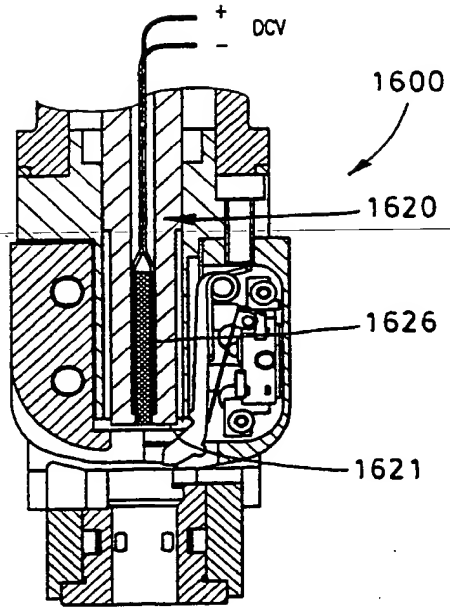


Fig 23

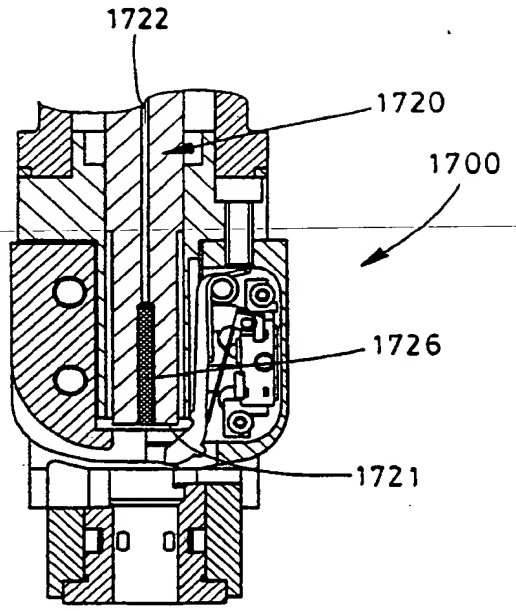


Fig 24

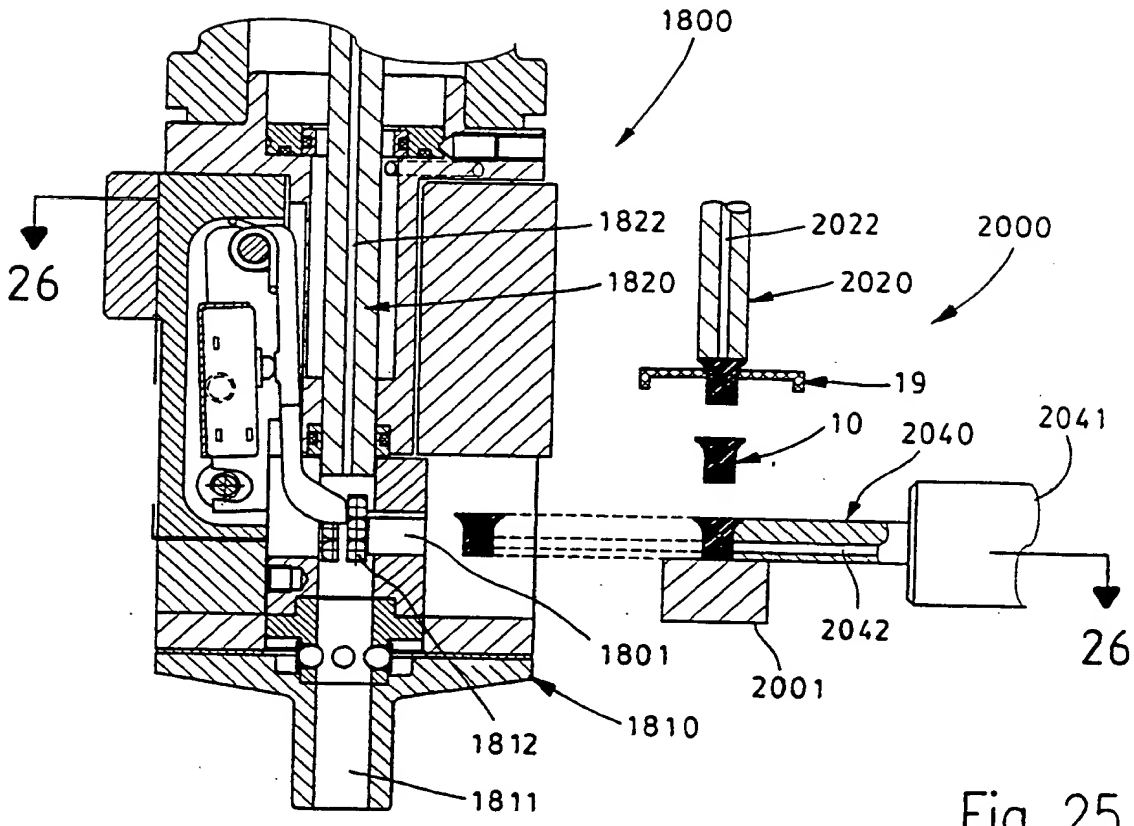


Fig 25

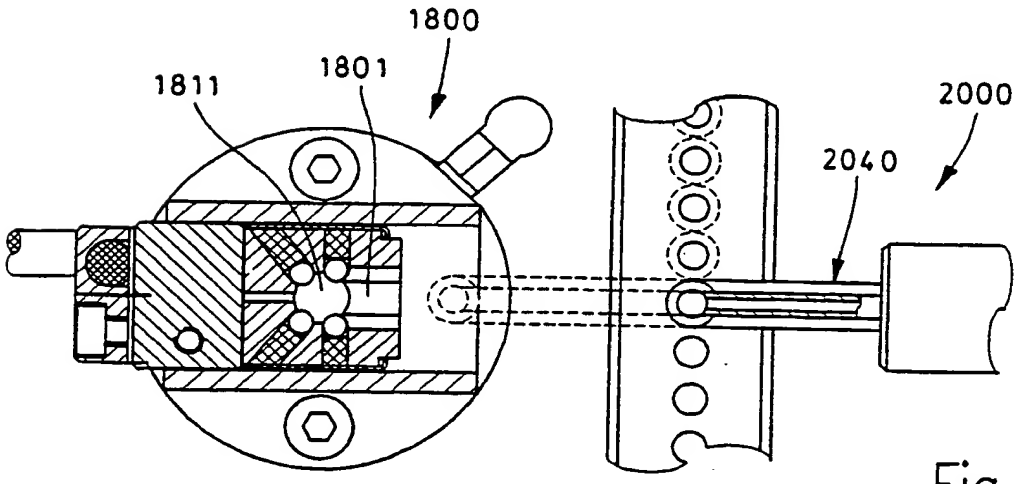


Fig 26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 95/00219

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[6] B21J 15/30, 15/32, B25B 23/08, 23/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC B21J 15/30, 15/32, B25B 23/08, 23/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X Y	AU 89616/91 A (AOYAMA) 18 June 1992 paragraph bridging pages 7-8 pages 8-12	1-3,11-12 6,11.
X	Patent Abstracts of Japan, M-1626, page 152, JP, 6-79640 A (JAPAN SERVO CO LTD) 22 March 1994 abstract	1.
X	Patent Abstracts of Japan, M-1490, page 147, JP, 5-154597, A (DAIKIN MFG CO LTD) 22 June 1993 abstract	1.

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 June 1995	6 July 1995 (06.07.95)
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No. 06 2853929	Authorized officer D.G. FRY Telephone No. (06) 2832130

Form PCT/ISA/210 (continuation of first sheet (2)) (July 1992) copgid

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	GB 2036623 A (ARCANGELL) 2 July 1980. column 1 line 52	1
X	GB 1313913 A (GARDNER-DENVER COMPANY) 18 April 1973. page 1 lines 74-80	1.
X	US 2013826 A (JACOBSON) 10 September 1935. figure 2 and description	1.
X	US 2531515 A (JOHNSON) 28 November 1950. figures 1,6 and description	1.
X	DE 214328 A (VEB STAHL UND WALZWERK GROEDITZ) 10 October 1984. figure	1.
Y	WO 94/15736 A (HENROB LTD) 21 July 1994. fastener centratising means, blow feeder	6,11.
Y	GB 2079717 A (FURMA MANUFACTURING CO) 27 January 1972. figure 7	11.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 95/00219

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	89616/91	CN	1062685	EP	491484	JP	4217435
		JP	5077118				
GB	1313913	DE	2037570	US	3616827		
WO	9415736	AU	58292/94				
GB	2079717	AT	3170/81	BR	8104616	CA	1164329
		CH	640158	DE	3127802	DK	3213/81
		ES	504048	FR	2486909	IL	63225
		IN	154823	IT	1142781	JP	57052542
		NL	8103407	NO	812414	NZ	197560
		SE	8104420	US	4404742	ZA	8104699

END OF ANNEX

EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 56077042
PUBLICATION DATE : 25-06-81

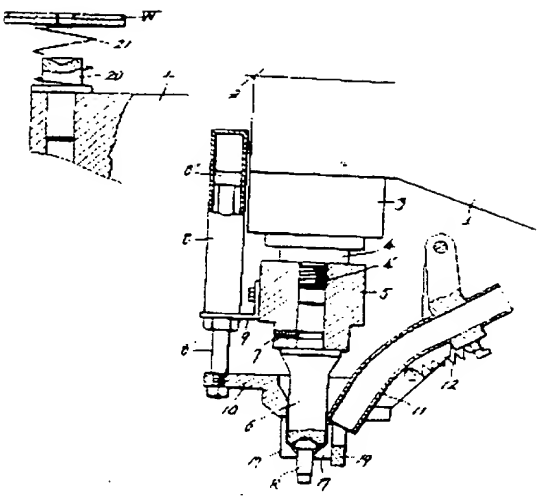
APPLICATION DATE : 26-11-79
APPLICATION NUMBER : 54152737

APPLICANT : PRESS KOGYO KK;

INVENTOR : KOHAMA HARUHIDE;

INT.CL. : B21J 15/32 B21J 15/20 B21J 15/30
B21J 15/44

TITLE : METHOD AND DEVICE FOR CAULKING RIVET SIMULTANEOUSLY WITH ITS INSERTION



ABSTRACT : PURPOSE: To perform the insertion and caulking of a rivet requiring large load simultaneously by so pivoting an air feed pipe to an inserting body as to be oscillatable around the inserting body and capable of moving the inserting body upward and downward.

CONSTITUTION: A rod 4 and an inserting body 10 are lowered by the operation of a hydraulic cylinder 2. When the blocking plate 19 of the body 4 abuts on the work W, pawl bodies 17, 17 are gradually opened by the downward movement of a caulking means 6. At the same time, the body 10 ascends relatively with the means 6 and the piston 8" of an air cylinder 8 also rises. When the means 6 descends further, the rivet R detaches from the pawl bodies 17, 17, and is inserted into the work hole. As the rod 4 descends in succession, the rivet R is caulked by caulking means 6, 20. Upon completion of the caulking, the means 6 is moved upward and the cylinder 8 lowers the body 10. When the cylinder 8 reaches the upper limit position and the body 10 reaches the lower limit, an air feed pipe 11 suplies the rivet R to the pawl parts 17, 17 thence it is released to the original position by oscillating around the fulcrum along the means 6.